Utilization of biomasses to reduce the risks of soil erosion:
First test of *vetiveria zizanioides* harvesting

L. Pari*
Istituto Sperimentale di Meccanizzazione Agricola, via della Pascolare 16, Monterotondo, Roma, Italy
Tel + 39 06 9067917; Fax +39 06 90625591; ismapari@uni.net

Introduction

Among the renewable resources of energy, biomass has high potentiality. If however we consider only the energetic aspects, the intrinsic potential of this natural resources is not entirely gathered. Infact biomass can contribute to the reduction of the atmospheric pollution, to the defense of the ground, to the correct management of the refusals, to the creation of places of employment, to the rural development, etc.

One of the most important and actual aspects is the protection of the territory. Many grounds exist all over the world under erosion risk. For instance, the agricultural grounds withdrawn by the food production are left often under conditions of extreme abandonment. These fields go toward to an increasing degradation, with irreversible damages.

In many areas of Italy, modern agriculture has determined often a progressive reduction of the number of the crops adopted in the productive systems , a progressive simplification of the crops alternations (up to reach the the one crop cultivation) and a more and more careful struggle to the weeds, with the consequent reduction of the vegetable biodiversity (both of the crops and of the spontaneous species). A wider cultivation of biomasses with environmental finality could mitigate this excessive pressure on the natural environment.

Biomasses can certainly represent a very effective mean to reduce the risks of erosion of the slope areas . In fact the vegetable coverage directly constitutes a valid protection of the ground against rain ranoff, the radical apparatus contain the ground and for the effect of natural manuring of the fallen leaves on the ground it increase the organic substance in the superficial layers.
Among the biomass crops that can be used to better defend the territory from the erosion, the vetiveria (*vetiveria zizanioides*) it is one of the most interesting.

Vetiveria zizanioides

Vetiveria zizanioides is one of the 12 species of the genera Vetiveria and it is native of southern Asia. For the consolidation of grounds subjects of erosion or moving, hedges of vetiveria are installed along the lines of ground level so that the hedge is perpendicular to the preferential direction of sliding water.

Thanks to the growth speed of the roots and the plant ability to resprout from the collar of the plant, the hedge takes short time to create an elastic net in the ground constituted by the interlacement of the roots for a depth of 2 - 3 meters.

Besides the aerial part of the plant will slow down the water ranoff holding back the particles of ground transported by the water.

In fact the closed hedges of vetiveria realize a ground hedge more and more pronounced due to the arrest of the corroded ground on the upper side.

With the purpose to set a machineries chain to harvest vetiveria, harvesting tests have been conducted on an experimental vetiveria field with an harvesting chain normally used for haying.

Material

The experimental field, cultivated nearby Grosseto, has been installed in October 1998 and had developed therefore during the harvest (April 2000) an entire vegetative cycle.

Comparison between two thesis both in plots of 480 m_2 where compared. Thesis A with plant distance of 0,5 m X 0,5 m, correspondent to an investment of 1920 plants (40000 plant/hectare) and Thesis B with plant distane of 0,35 m X 0,35 m, correspondent to an investment of 3918 plants (81630 plant/hectare);.

Description of the harvesting chain
The harvesting chain used for the tests was constituted by one tractor combined in sequence to three separate operative machineries: mower, rake and baler.
The tractor was a Fiat 580 with power equal to 44 kWs.
The mower was an OTMA BFD 180, 1,8 m width cut.
The rake was a 2 wheels rake powered by the tractor, and it had a working width of 2,4 m creating 1,2 m width windrows.
The baler was a FERABOLI FF 44 H.
With this type of baler, the pressure selected by the operator is practiced on the product picked up since the beginning of the formation of the bale getting therefore bales of different diameter (in relationship to the quantity of picked product) all with the same pressure.
In the tests this was a positive factor allowing us to form bales of different diameter with the product of every thesis so that was possble to evaluate the different productivity of the thesis.

Methods
Test on the plants to be picked up.
On the plants of the two thesis tests have been performed to appraise the number of shoot per plant, the plant width and the heights of the stem.
The data of the champions has been therefore elaborate to find the arithmetics averages.

Test on the harvesters
The harvesting times has been evaluated according to the official methodology of the Comitè Iternational of Organisation Scientifique du Travail en Agricultures (C.I.O.S.T.A.) and the recommendation of the Italian association of Genio Rurale (A.I.G.R.) 3A R1 relieving with a chronometer the necessary times to the different operations during the harvest.
Subsequently the data have been elaborated to find, for every thesis and for every operative machineries, indications on the their performances.

Test on the work quality
The possible damages suffered by the plants following the mower cut and by the passage of the rake, have been noticed. On the whole plots all the lossese product has manually been picked up and then weighed.

Results
The thesis A results more developed in comparison to the thesis B having a greater number of shoots for plant (35,33), a larger plat diameter (208 mms) and an everage height of the plants (1,27 ms) higher.
As it regards the productive characteristics of the crop, the thesis A surely has a superior production (14,65 tons/hectare) in comparison to the thesis B (10,13 tons/hectare).

The production of dry matter results to be 9,68 tons/hectare for the thesis A and 7,02 tons/hectare for the thesis B.

Conclusions
These first experiences showed the possibility to harvest vetiveria plants using the harvesting chain of haying without modifications to the mechanical apparatus.

The performances shown by the operative machineris can surely be improved if the operator acquires greater experience in harvesting vetiveria or if operative machineries with great operational capacity are used.

The possibility to harvest also the roots of vetiveria (for fragrance production) easily as the plant as to be verified. Surely the introduction of this crop will involve also the study of the root harvesting that must have performances such to make economically usable the roots for fragrance production.